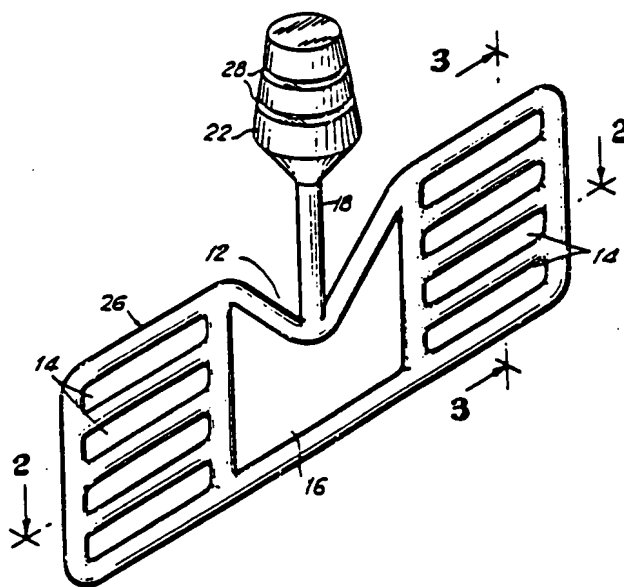


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(54) Title: DENTAL IMPLANT



(57) Abstract

A prosthetic dental implant (10) comprises a body (26) having a depression (12) in the upper portion thereof, an enlarged space (16) beneath the depression (12), at least one additional opening (14) therein, and a neck (18) joined to the body (26) substantially at the nadir (30) of the depression (12). A prosthetic dental implant (10) having entirely rounded surfaces beneath the gum line is also disclosed.

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DENTAL IMPLANT

Technical Field

5 This invention pertains to oral prosthetic implants. The device is surgically implanted providing support means for one or more crown replacements and artificial teeth.

Background Art

10 Teeth are lost due, among other things, to damage from accident or injury, or by disease. Replacing teeth which have been lost may be accomplished by using either a permanent or removeable bridge. In certain situations prosthetic restoration is desirable and dental implants are used. However, known dental prostheses have disadvantages which often result in failure of the
15 implant. One cause of implant failure is infection. When an alloplastic material is introduced into bone tissue, resorption of the bone at the site of penetration occurs. The lost bone tissue is replaced by epithelium and connective tissue. This epithelial downgrowth, as it is
20 known, provides a path for bacteria to penetrate the area around the implant beneath the gum line. Infection ensues, and can eventually leads to furca type involvement.

25 The configuration of known implants do not adequately address this problem. Moreover, once such infection does occur, their configurations are ill-suited for achieving adequate cleaning of the infected area, with the ultimate consequence of persistent infection and eventual implant failure.

30 The second major cause of implant failure results from chronic inflammation of the collagen capsule and associated bone tissue depletion. Dental implants are subjected to tremendous mechanical stress from biting and chewing. Known dental implants characteristically have
35 corners and other sharp edges. It is these edges which damage the fragile collagen capsule which joins the implant to the surrounding bone tissue. This creates chronic inflammation surrounding the implant. The

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ultimate result is bone tissue dissolution and eventual implant failure.

5 It is therefore an object of the present invention to enhance success of dental prosthetic restoration by more effectively controlling bacterial infection.

It is a further object of the invention to extend the life of a dental prosthetic restoration by reducing trauma to the collagen capsule.

Disclosure of the Invention

The implant in accordance with the present invention comprises a body having a depression in the upper surface thereof, an enlarged space beneath the depression, and at least one additional opening therein, and a neck joined to the body substantially at the nadir of the depression. The implant of the invention, and particularly the depression and the enlarged central space therebeneath, serve to retard bacterial infection of the tissue surrounding the implant, and to facilitate cleaning of such infection as does occur, all as will be more fully described below.

In a preferred embodiment, the body is substantially flat and of generally rectangular shape, and all the surfaces of the implant beneath the gum line are rounded to minimize trauma to the collagen capsule which forms about the implant following implantation. Also in the preferred embodiment, the neck is elongated, having an overall length of about 4-8mm, thereby extending the time when epithelial downgrowth and accompanying bacterial infection ultimately reach the body of the implant.

The invention also comprises a dental implant comprising a body defining at least one opening therein, a neck secured to the body and extending upwardly therefrom, the body and at least the portion of the neck for disposition below the gum line being comprised of entirely rounded surfaces for minimizing trauma to the collagen capsule.

Further features and advantages of the dental implant in accordance with the present invention will be more fully apparent from the following detailed description and annexed drawings of the presently preferred embodiment thereof.

Brief Description Of The Drawing

In the drawings, wherein like numerals represent like parts:

5 FIG. 1 is a perspective view of the dental implant in accordance with the present invention;

 FIG. 2 is a cross-sectional view taken substantially along line 2-2 of FIG. 1 illustrating the rounded surfaces of the dental implant of the invention;

10 FIG. 3 is a cross-sectional view taken substantially along line 3-3 of FIG. 1 further illustrating the rounded surfaces of the dental implant of the invention;

15 FIG. 4 is an elevational view of an embodiment of the invention for supporting multiple teeth or crown; and Fig.5 is a perspective view of an alternative embodiment of a dental implant according to the invention.

- 5 -
Best Mode For Carrying Out The Invention

Referring now to the drawings, and initially to FIG. 1, 10 designates the preferred embodiment of the dental implant in accordance with the present invention.

5 As shown in FIG. 1, the implant 10 has a substantially flat, rectangular body 26. A substantially V-shaped depression 12 is formed in the upper portion of the body 26 substantially at the midpoint thereof, and an enlarged space or opening 16 is provided in the body 26
10 beneath the depression 12. The portions of the body 26 on either side of the enlarged space 16 each define a plurality of elongated openings 14. A neck 18 of substantially uniform circular cross-section throughout is joined to the body 26 at the nadir of the depression 12. The neck has a
15 height of about 4-8mm and extends approximately 4mm above the non-recessed upper surface of the body 26. A conventional frustum-shaped support post 22 is attached to the upper end of the neck 18. As best shown in FIGS. 1-3, all the surfaces of the body 26 and the neck 18 are
20 rounded.

The preferred method of making the dental implant of the present invention includes preparing a mold from a plastic or wax pattern, then casting in a surgical grade alloy or other suitable material, such as plastic or
25 ceramic. This conventional wax lost technique is within the knowledge of the person of ordinary skill in the art and a further description thereof is therefore deemed unnecessary. The body 26 of the preferred implant is approximately 18 gauge thickness, while the thickness of
30 the neck is approximately 14 gauge.

In use, the dental prosthetic device 10 of the invention is surgically implanted in the jawbone such that the upper surface of the implant is generally between
2-3mm below the bone level. With the prosthetic device 10
35 thus implanted, the frustum-shaped support post 22 protrudes above the gum line, and a crown or artificial tooth may be secured thereto as by a suitable adhesive. The

support post 22 is provided with grooves 28 for receiving the adhesive for enhancing securement of the tooth or crown to the post 22.

5 Following implantation, bone tissue grows
through the openings 14 and space 16 in the body 26 and
serves to anchor the implant in place in the jawbone. It
is desirable that the openings 14 on either side of the
enlarged space 16 comprise smaller, elongate openings
rather than larger openings. This is preferable because
10 the structure of the body 26 defining these smaller
openings 14 provides increased surface area for anchoring
the implant 10 as the growth of surrounding bone tissue
fills the openings 14. Also, by employing horizontal
struts for defining horizontal openings 14, the vertical
15 forces transmitted to the implant 10 during chewing, for
example, are more evenly distributed and the life of the
implant thereby prolonged. Consequently, by providing
these smaller, elongate openings 14 on either side of the
body 26 to provide sufficient anchoring, the opening 16
20 beneath the neck 18 may be enlarged for accomplishing the
functions described below.

 The preferred dental implant of the invention
has several features which enhance its useful life by
facilitating maintenance and slowing deterioration of
25 surrounding tissue. One such feature is the central dis-
position of the neck 18 within the V-shaped depression 12.
As noted previously, bone resorption and consequent
epithelial downgrowth, which are normal reactions to
insult with an alloplastic material, generally begins at
30 the site where the implant penetrates the gum and bone
i.e. at the neck of the implant. If the upper surface of
the implant were not provided with the depression 12,
epithelial downgrowth along the neck 18 would more rapidly
reach the body 26. Once such furca-type involvement
35 occurs, there is an enhanced probability of infection from
bacteria which penetrates the tissue to the extent of the
epithelial downgrowth. By recessing the neck-body

junction 30 of the implant, epithelial downgrowth and hence bacterial infection of tissue surrounding the body 26 is delayed with consequent extension of the useful life of the implant. Moreover, cleaning of such bacterial invasion that does occur in the vicinity of neck 18 is facilitated by the configuration of the depression 12, which is wider at the top than at the bottom, as this configuration allows easy insertion of dental implements into the depression for combating bacterial infection.

Another feature of the invention which enhances its useful life is the provision of the large space 16 beneath the depression 12. More particularly, epithelial downgrowth typically follows the structural components of the implant. Therefore, a structural component extending directly from the bottom of the neck to the bottom of the body would provide a direct path for epithelial downgrowth and consequent deep infection. As will be apparent from FIG. 1, the large space 16 beneath the neck 18 in the implant 10 of the present invention avoids such a direct path thereby delaying if not reducing the occurrence of deep infection. Furthermore, upon occurrence of infection beneath the neck 18, the enlarged central space 16 facilitates cleaning and maintenance of the involved area as its size renders it more readily accessible to dental implements.

Also, the neck 18 of the preferred implant 10 is longer than those of prior art implants. In particular, in the preferred embodiment the neck extends approximately four millimeters above the top of the non-depressed regions of the upper surface of the body 26. This allows the device to be implanted somewhat deeper into the jawbone. In addition, there is an additional length of about 2-4 millimeters of neck extending into the depression 12. After the implant is surgically implanted, it is contemplated that about 4-8 millimeters of neck will be below the gum line, depending upon the implant site. Since the primary path of epithelial downgrowth is along

the neck, it will be appreciated that this longer length of neck 18 between the gum line and the body 26 will delay epithelial downgrowth and resulting bacterial infection from reaching the body 26. This is advantageous since, as noted above, bacterial infection is more difficult to treat once it reaches the body 26.

Another feature of the preferred dental implant of the invention is the provision of all rounded surfaces which serves to reduce damage to the collagen capsule which forms around the implant following implantation. More specifically, the junction between the dental implant and the collagen capsule is subjected to repeated and severe mechanical stress from chewing and biting. Such mechanical stresses are highest at sharp edges or corners of known implants, and rupture of the collagen capsule typically occurs at these sites. The result is chronic inflammation and dissolution of surrounding bone tissue which often leads to implant failure. Here, on the other hand, the rounded surfaces of the preferred dental implant according to the invention reduce the incidence of trauma to the collagen capsule, thereby reducing bone dissolution and increasing the implant's useful life.

Referring now to FIG. 4, a multiplicity of implants 10 of the type illustrated in FIGS. 1-3 are integrally joined, side-by-side, to form a single implant 50 capable of supporting a plurality of artificial teeth or crowns. Except for the fact that they are integrally joined, each unit of the implant 50 is identical to the implant 10 described above and hence incorporates all of the features and advantages thereof.

Referring now to Fig. 5, an alternative embodiment of an implant in accordance with the present invention is generally designated at 100. The implant 100 embodies the operative structural features of the implant 10 of Figs. 1-3, the primary difference being that the body 126 of the implant 100 is of open cylindrical construction as contrasted with the flat rectangular

construction of the implant 10. The implant 100 may be used for example in an extract site or a wide buccal lingual bone dimension.

5 As shown, the body 126 of the implant 100 comprises a plurality of equi-distant, horizontally oriented annular tiers 104, shown by way of example as five annular tiers, joined by a plurality of vertical support rods 106, shown by way of example as three
10 equidistant support rods. The annular elements 104 and vertical rods 106 define a multiplicity of horizontally extending openings 114 which serve the same function as the openings 14 of the embodiment of Figs. 1-3.

15 A central depression 112 is formed in the top of the implant 100 by a plurality of angled struts 108, each of which is joined at one end to the upper annular element 104 and at the other end to each other at a point of intersection 130 beneath the top of the body 126. The
20 struts 108 are joined at the point of intersection 130 with the neck 118 which has the usual support post 122 at its upper end. It will therefore be appreciated that the struts 108 define a central depression 112 about the neck 118 which serves the same function as the depression 12 in the implant 10 of the embodiment of Figs. 1-3. It will
25 also be appreciated that an enlarged space 116 is defined in the body 126 beneath the central depression 112. Again, this enlarged space 116 serves the same function as the enlarged space 16 beneath the depression 12 in the embodiment of Figs. 1-3. Finally, and as is also true of
30 the embodiment of Figs. 1-3, all of the surfaces of the implant 100 of Fig. 5 are rounded for reducing the incidence of trauma to the collagen capsule.

While I have herein shown and described and preferred embodiment of the preferred invention, persons or
35 ordinary skill in the art will recognize that changes and modifications may be made therein without departing from the spirit and scope of the invention. For example, while the recessed area 12 in the upper surface of the body 26

is shown and described as substantially V-shaped, it will be appreciated that the depression 12 may have other suitable shapes, such as semi-circular. The number and shape of the openings 14 on either side of the enlarged opening 16 may likewise be varied. Also, specially
5 designed necks 18 may be employed for special applications. For example, the length of the neck 18 may be varied from the dimensions given above. Likewise, the orientation of the neck with respect to the body 26 may be
10 other than vertical.

As a further alternative especially suited for implants following extraction or in other situations requiring healing without disturbance, the support 22 may be formed separately from the neck 18. In this embodiment, the neck 18 is provided with internal threads for
15 receiving external threads at the bottom of the support post 22. In use of this embodiment, the body 26 and connected neck 18 is first surgically implanted in the jawbone with the height of the neck being selected such
20 that the top thereof is beneath the gum line. After healing, a second incision is made to expose the top of the neck whereupon the support post 22 may be threaded thereon. Then, a crown or artificial tooth may be secured to the post 22. As noted, this embodiment is particularly
25 useful for procedures following tooth extraction, as it permits embedding the device into a recent extraction site while allowing time for healing before effecting tooth replacement. In the absence of the support post 22 and the artificial tooth or crown, there is little mechanical
30 stress transmitted to the implanted body 26, and hence healing is facilitated.

Still further changes and modifications will suggest themselves to those skilled in the art once this description is known. Accordingly, the above description
35 should be construed as illustrative, and not in a limiting sense, the scope of the invention being defined by the following claims.

CLAIMS

1. A prosthetic dental implant comprising
a body, said body having a depression in the
upper portion thereof, an enlarged space beneath said
depression, and at least one additional opening therein;
and

a neck joined to the body substantially at the
nadir of the depression.

2. The prosthetic dental implant according to
claim 1, wherein all of the surfaces of said body, and at
least the surface of the portion of the neck which will be
disposed beneath the gum line, are comprised of entirely
rounded surfaces.

3. The prosthetic dental implant according to
claim 2, wherein said body and said neck are comprised of
members having circular cross sections.

4. The prosthetic dental implant according to
claim 1, wherein said depression is wider at the top than
at the bottom.

5. The prosthetic dental implant according to
claim 4, wherein said depression is substantially
V-shaped.

6. The prosthetic dental implant according to
claim 4, wherein the nadir of said depression is
substantially at the center thereof.

7. The prosthetic dental implant according to
claim 1, wherein said enlarged space occupies
substantially the full height of said body beneath said
depression.

8. The prosthetic dental implant according to
claim 7, wherein the width of said central space is
substantially the same as the width of the widest portion
of said depression.

9. The prosthetic dental implant according to
claim 1, wherein a plurality of additional openings are
provided in said body.

10. The prosthetic dental implant according to

claim 9, wherein said additional openings are elongate and horizontally oriented.

5 11. The prosthetic dental implant according to claim 1, wherein said body is substantially flat, said space is centrally located in said body, and plurality of openings are provided on either side of said space.

 12. The prosthetic dental implant according to claim 11, wherein said body is of generally rectangular shape.

10 13. The prosthetic dental implant according to claim 1, wherein said body is substantially cylindrical.

 14. The prosthetic dental implant according to claim 13, wherein said body comprises a plurality of horizontal annular elements and a plurality of vertical supports connecting said annular elements, and wherein
15 said at least one additional opening comprises a plurality of elongate horizontal openings between said annular elements and said vertical supports.

 15. The prosthetic dental implant according to claim 1, wherein said neck extends about 2-4mm above the
20 non-depressed region of the upper portion of said body, and wherein the overall height of said neck is about 4-8mm.

 16. The prosthetic dental implant according to claim 1, wherein the implant is cast in surgical grade
25 alloy.

 17. The prosthetic dental implant according to claim 1, and further comprising a support post for
30 receiving an artificial tooth or crown secured to the upper end of said neck.

 18. The prosthetic dental implant according to claim 17, wherein said support post is integrally joined to said neck.

 19. The prosthetic dental implant according to claim 18, wherein said support post is releasably secured
35 to said neck, and further comprising means for releasably securing said support post to said neck.

20. The prosthetic dental implant according to claim 2, wherein said depression is wider at the top than at the bottom.

5 21. The prosthetic dental implant according to claim 20, wherein said enlarged space occupies substantially the full height of said body beneath said depression.

10 22. The prosthetic dental implant according to claim 21, wherein a plurality of additional openings are provided in said body.

23. The prosthetic dental implant according to claim 22, wherein said body is substantially flat, said space is centrally located, and a plurality of openings are provided on either side of said space.

15 24. The prosthetic dental implant according to claim 23, wherein said body is of generally rectangular shape.

20 25. The prosthetic dental implant according to claim 23, wherein said neck extends about 2-4mm above the non-depressed region of the upper portion of said body, and wherein the overall height of said neck is about 4-8mm.

26. The prosthetic dental implant according to claim 22, wherein said body is substantially cylindrical.

25 27. The prosthetic dental implant according to claim 26, wherein said body comprises a plurality of horizontal annular elements and a plurality of vertical supports connecting said annular elements, and wherein said at least one additional opening comprises a plurality of elongate horizontal openings between said annular elements and said vertical supports.

30 28. The prosthetic dental implant according to claim 27, wherein said neck extends about 2-4mm above the non-depressed region of the upper portion of said body, and wherein the overall height of said neck is about 4-8mm.

29. A dental implant comprising a body having

an opening therein, a neck secured to said body and extending upwardly therefrom, said body and at least the portion of said neck for disposition below the gum line being comprised of entirely rounded surfaces for
5 minimizing trauma to the collagen capsule forming about the implant following implantation.

30. The implant according to claim 29, wherein said body is substantially flat.

31. The implant according to claim 30, wherein
10 said body is of generally rectangular shape.

32. The implant according to claim 31, wherein said body is comprised of elements having circular cross sections.

33. The implant according to claim 32, wherein
15 said body has a plurality of openings therein, including a large, central space, and a plurality of smaller openings on either side of said central space, and wherein said body has a depression in the upper portion thereof above said central space, said neck being joined to said body at
20 the nadir of said depression.

34. The implant according to claim 29, wherein said body is substantially cylindrical.

35. The implant according to claim 34, wherein
25 said body is comprised of elements having circular cross sections.

36. The dental implant according to claim 35, wherein said body comprises a plurality of horizontal annular elements and a plurality of vertical supports connecting said annular elements, wherein said body has a
30 plurality of openings therein including a large central space and a plurality of smaller openings defined between said annular elements and said vertical supports, and wherein said body has a depression in the upper portion thereof above said central space, said neck being joined
35 to said body at the nadir of said depression.

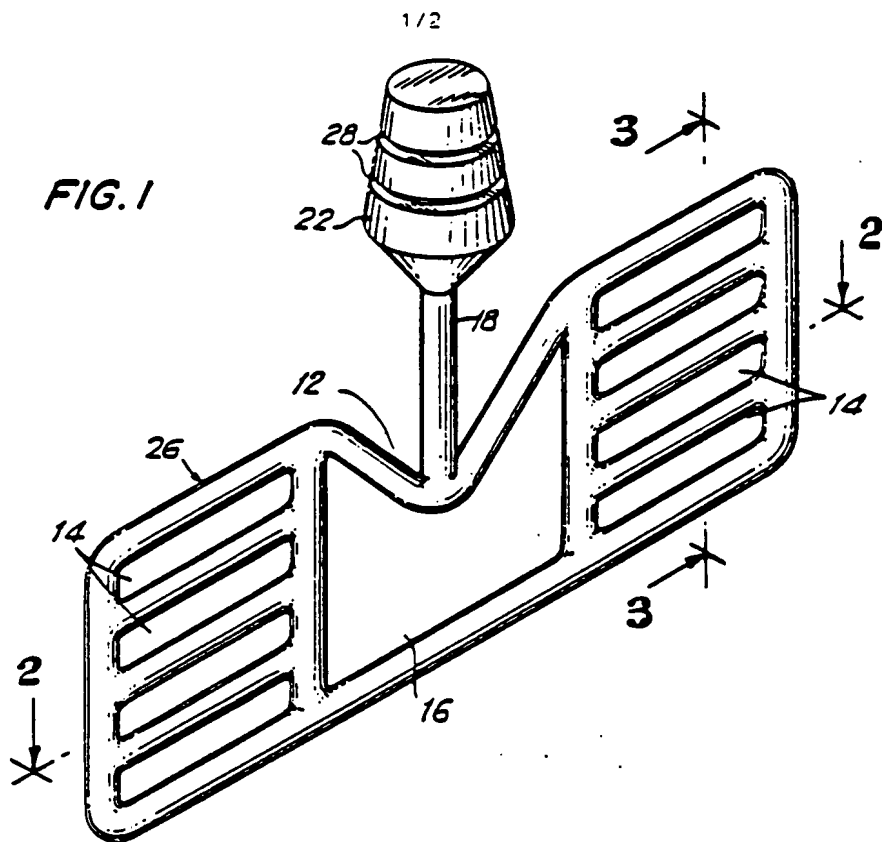


FIG. 3

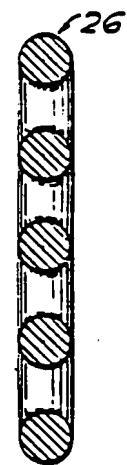


FIG. 2



FIG. 4

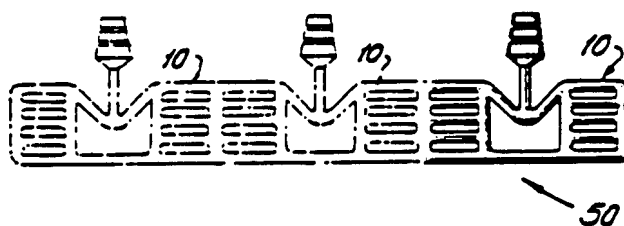
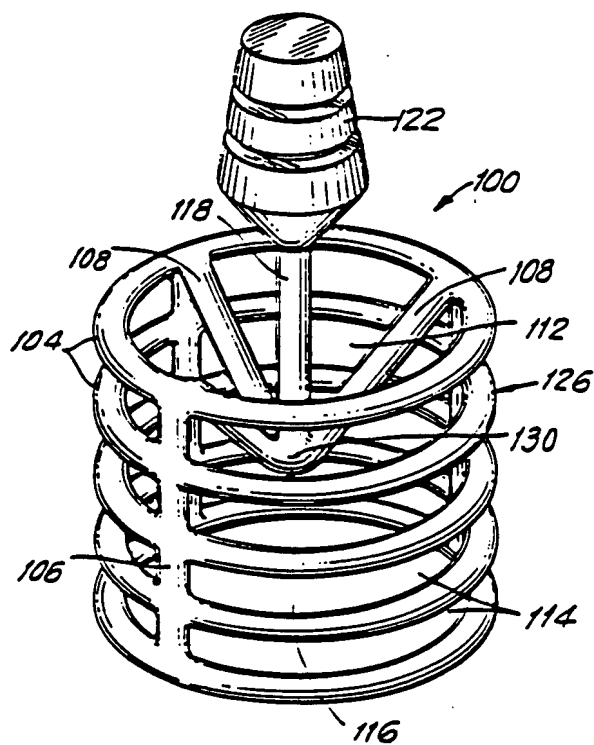
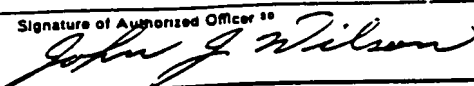


FIG. 5



INTERNATIONAL SEARCH REPORT

International Application No. PCT/US85/01751

I. CLASSIFICATION OF SUBJECT MATTER (If several classification symbols apply, indicate all) ¹ According to International Patent Classification (IPC) or to both National Classification and IPC Int. Cl. ⁴ A61C 8/00 U.S. CL. 433/173		
II. FIELDS SEARCHED Minimum Documentation Searched ⁴ Classification System: U.S. Classification Symbols: 433/173, 175, 176		
Documentation Searched other than Minimum Documentation to the Extent that such Documents are included in the Fields Searched ⁴		
III. DOCUMENTS CONSIDERED TO BE RELEVANT ¹⁴		
Category ¹⁵	Citation of Document, ¹⁶ with indication, where appropriate, of the relevant passages ¹⁷	Relevant to Claim No. ¹⁸
X	US, A, 4,121,340 24 October 1978 Patrick	1-36
X	US, A, 3,977,081 31 August 1976 Zambelli et al	2, 20-36
X	US, A, 3,952,414 27 April 1976 Shovers et al	3, 13-14, 32, 34-36
P	US, A, 4,521,192 04 June 1985 Linkow	1-36
X	US, A, 3,837,080 24 September 1974 Pasqualini	19
A	US, A, 3,579,831 25 May 1971 Stevens et al	
A	US, A, 3,798,771 26 March 1974 Edelman	
A	US, A, 3,866,321 18 February 1975 Valen	
<p>¹⁵ Special categories of cited documents:</p> <p>"A" document defining the general state of the art which is not considered to be of particular relevance</p> <p>"E" earlier document but published on or after the international filing date</p> <p>"L" document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified)</p> <p>"O" document referring to an oral disclosure, use, exhibition or other means</p> <p>"P" document published prior to the international filing date but later than the priority date claimed</p> <p>"T" later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention</p> <p>"X" document of particular relevance: the claimed invention cannot be considered novel or cannot be considered to involve an inventive step</p> <p>"Y" document of particular relevance: the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art.</p> <p>"G" document member of the same patent family</p>		
IV. CERTIFICATION		
Date of the Actual Completion of the International Search ¹ 23 SEPTEMBER 1985 International Searching Authority ¹ ISA/US		Date of Mailing of this International Search Report ¹ 27 NOV 1985 Signature of Authorized Officer ¹⁰ 

FURTHER INFORMATION CONTINUED FROM THE SECOND SHEET

A	US, A, 3,979,828 14 September 1976 Taylor
A	US, A, 4,302,188 24 November 1981 Driskell
A	US,A, 4,420,305 13 December 1983 Linkow

V. ☐ OBSERVATIONS WHERE CERTAIN CLAIMS WERE FOUND UNSEARCHABLE ¹⁰

This international search report has not been established in respect of certain claims under Article 17(2) (a) for the following reasons:

1. ☐ Claim numbers because they relate to subject matter ¹¹ not required to be searched by this Authority, namely:

2. ☐ Claim numbers because they relate to parts of the international application that do not comply with the prescribed requirements to such an extent that no meaningful international search can be carried out ¹², specifically:

VI. ☐ OBSERVATIONS WHERE UNITY OF INVENTION IS LACKING ¹³

This International Searching Authority found multiple inventions in this international application as follows:

1. ☐ As all required additional search fees were timely paid by the applicant, this international search report covers all searchable claims of the international application.

2. ☐ As only some of the required additional search fees were timely paid by the applicant, this international search report covers only those claims of the international application for which fees were paid, specifically claims:

3. ☐ No required additional search fees were timely paid by the applicant. Consequently, this international search report is restricted to the invention first mentioned in the claims; it is covered by claim numbers:

4. ☐ As all searchable claims could be searched without effort justifying an additional fee, the International Searching Authority did not invite payment of any additional fee.

Remarks on Protest

- ☐ The additional search fees were accompanied by applicant's protest.
☐ No protest accompanied the payment of additional search fees.